

Woodpile-type photonic crystals composed of air columns

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Three-dimensional photonic crystals are ultimate light-confining structures. However, realizing these structures is difficult due to complicated fabrication techniques. We will describe woodpile-type PhCs composed of air columns, which can be fabricated using a simple technique, based on 45-deg-angled dry etching.

This woodpile structure is composed of air columns ($n=1$) surrounded by Si ($n=3.5$). Band calculation based on the plane-wave method shows that the complete band gap is obtained for ℓ (width of column cross section) $=0.4\sim0.6\times(\text{column period})$, when the column has a regular square cross section, even though the gap remains small. On the other hand, a large gap can be obtained for the rectangular cross section. The gap-midgap ratio exceeds 20% for the column cross section with a lateral- and vertical- width ratio of 2.4 (Fig. 1). We will also present a newly developed fabrication technique using an ICP deeply etching method [1].

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[1] K. Hosomi et al., PECS-V, Mo-P1, p. 19 (2004)

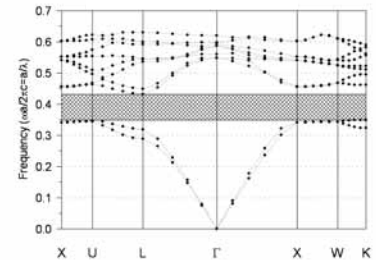


Fig. 1 Band structure for the column with a lateral- and vertical- width ratio of 2.4 .